

CDC and TheraDoc Collaborate on Electronic Surveillance of Antimicrobial Use and Resistance

Technology Enables Efficient Data Transmission and Evaluation

by Stanley L. Pestotnik, MS, RPh

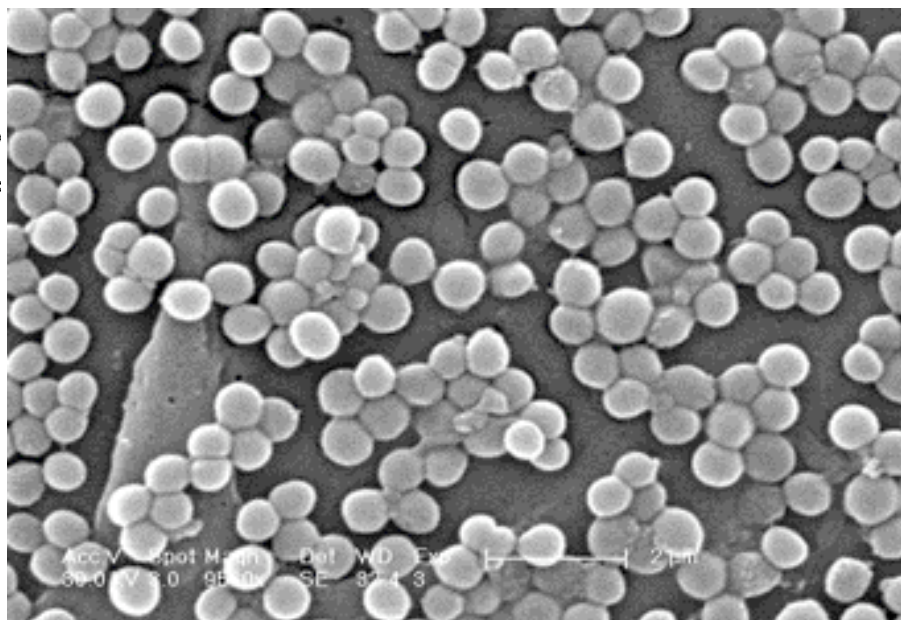
CDC Promotes Standards for Surveillance of Antimicrobial Resistance

During the past 30 years the Centers for Disease Control and Prevention (CDC) has monitored two major patient safety issues—hospital-acquired infections (HAIs) and antibiotic resistance—through its National Nosocomial Infections Surveillance (NNIS) system. The agency furthered its ability to collect data critical to achieving its patient safety efforts with the launch of the National Healthcare Safety Network (NHSN) in 2005. NHSN is a surveillance and knowledge system for accumulating, exchanging and integrating relevant information to support local and national efforts to protect patients and promote healthcare safety.

In 2003, CDC launched an electronic surveillance research project to monitor antibiotic use and resistance in U.S. hospitals. Called the AUR eSurveillance project, the initiative is part of the research and development component of NHSN.

A main goal of the AUR eSurveillance project is to define industry-standard data exchange and messaging specifications that all vendors and providers can use to report AUR data. Standards are the backbone of information technology and ensure consistency between and interoperability of different data systems. Standards are fundamental for accuracy and usability of electronic data systems, including electronic surveillance systems. Once standards are defined and adopted, stakeholder (e.g., providers, vendors,

CDC/Janice Carr/Jeff Hageman, M.H.S.



Methicillin-resistant *Staphylococcus aureus* bacteria, commonly referred to by the acronym, MRSA; Magnified 9560x.

regulatory agencies, etc.) collaboration will be improved. CDC is to be commended for taking an active role in fostering collaborations to define industry-standard data exchange and message specifications that all healthcare information systems can use to participate in national patient safety initiatives such as AUR monitoring.

Messaging standards, as well as data exchange and vocabulary standards, enable interoperability and connectivity within healthcare IT systems. Each of these is essential to the successful transmission of AUR data, as are the interoperability standards promoted by the Public Health Information Network (PHIN).

Strict adherence to industry standards enabled the timely collection and delivery of accurate clinical and pharmacy data. Most important, standards enable the technology to present reports to clinical personnel in a single view that increases the user's ability to compile and analyze the data. This enables

quick interpretation, evaluation and utilization of data that are critical to tracking trends and identifying resistance, and seamlessly feeding information back to interested parties.

The application of standards to enable the near real-time transmission of clinical data that are easily understood by healthcare information systems *and* personnel is truly groundbreaking. Streamlined, standards-based reports allow organizations to maximize the use of clinical data and create robust infection surveillance systems.

CDC's Division of Healthcare Quality Promotion (DHQP) is collaborating with TheraDoc®, a clinical informatics company that has developed and markets a real-time, standards-based infection surveillance and reporting technology. This technology has been implemented in hospitals across the country to enhance infection control and prevention programs. CDC is working with TheraDoc to apply this technology to antimicrobial use and resistance monitoring. Both parties are

**National Healthcare Safety Network
AUR Summary of E-Surveillance Data
Monthly Report Form**

FacilityID=10000 patient

Reg	Standardized and analyzed data from TheraDoc Clients populate NHSN databases within CDC				Total Tested	% Susceptible	% Non-Susceptible
Acid-fast bacillus					30	0	0
Acinetobacter sp					2	0	0
	AMIKACIN	4	0	0	4	100	0
	AMOXICILLIN+ CLAVULANATE	0	0	1	1	0	100
	AMPICILLIN	0	0	1	1	0	100
	AMPICILLIN+ SULBACTAM	2	1	0	3	67	33
	CEFAZOLIN	0	0	1	1	0	100
	CEFOTAXIME	0	0	1	1	0	100
	CEFOXITIN	0	0	1	1	0	100
	CEFTAZIDIME	3	0	0	3	100	0
	CEFUROXIME	0	0	1	1	0	100
	CIPROFLOXACIN	1	0	3	4	25	75
	GENTAMICIN	1	1	2	4	25	75
	IMPENEM	3	0	0	3	100	0
	MEROPENEM	1	0	0	1	100	0
	MINOCYCLINE	2	0	1	3	67	33
	PIPERACILLIN	1	0	2	3	33	67
	PIPERACILLIN+ TAZOBACTAM	0	0	1	1	0	100
	TRIMETHOPRIM+ SULFAMETHOXAZOLE	2	0	2	4	50	50
Actinomyces species		0	0	0	3	0	0

**National Healthcare Safety Network - Antimicrobial Use and Resistance (AUR)
Microbiology Lab Data
Monthly Report Form**

FacilityID=10000 Month=8 Year=2006 L

Standardized and analyzed data from TheraDoc
Clients populate NHSN databases within CDC

	Susceptible	Intermediate	Resistant	Total Tested
GRAM POSITIVE ORGANISMS				
Coagulase-negative staphylococci				
vancomycin	0	0	0	0
Enterococcus spp.				
vancomycin	10	0	1	11
Staphylococcus aureus				
oxacillin	0	0	0	0
vancomycin	0	0	0	0
GRAM NEGATIVE ORGANISMS				
Acinetobacter spp.				
amikacin	1	0	0	1
cefepime	0	0	0	0
ceftazidime	1	0	0	1
imipenem	1	0	0	1
piperacillin/tazobactam	0	0	0	0
ampicillin/sulbactam	1	0	0	1
Enterobacter spp.				
cefotaxime	0	0	0	0
ceftazidime	0	0	0	0
imipenem	0	0	0	0
meropenem	0	0	0	0
Escherichia coli				
cefotaxime	0	0	0	0
ceftazidime	4	0	0	4
ciprofloxacin	0	0	0	0
Klebsiella pneumoniae				

working in collaboration with standards bodies such as Health Level 7 (HL7) to define industry standards for electronic antimicrobial use and resistance surveillance. Other vendors of electronic surveillance systems are being recruited to participate in these collaborations.

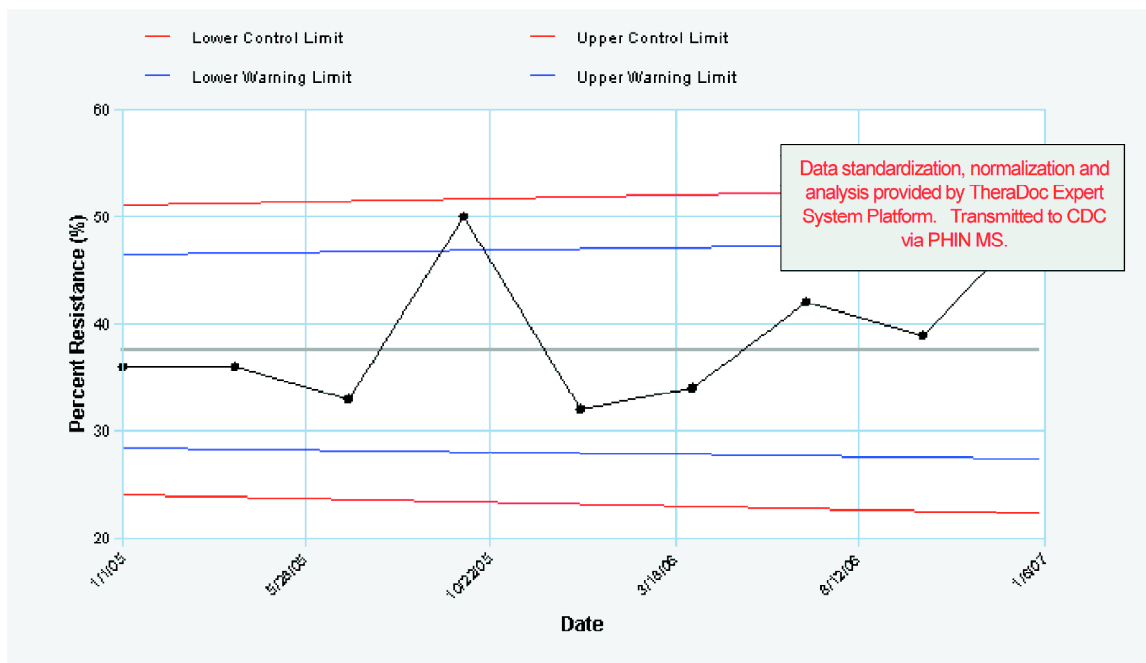
Two Innovative Hospitals Lead the Way to Nationwide Surveillance

The University of Utah Hospital was selected as a pilot site for the AUR eSurveillance project. On October 2, 2003 at 2:00 p.m. MST, the first patient-level microbiology data using the new message specification was transmitted to CDC. This moment marked a milestone in the history of the agency's efforts to improve patient safety by gathering and analyzing

patient-specific data from hospitals. It was the first time that microbiology data relative to individual results was electronically provided to the CDC—and in an extremely timely manner. These vital data could serve many purposes with regard to addressing antimicrobial resistance, one of which might be to generate near real-time antibiograms and quantify antibiotic drug use.

The University of Utah Hospital has been successfully transmitting messages of microbiology data to CDC for more than three years. The newest pilot hospital in the AUR eSurveillance project is Chicago's Northwestern Memorial Hospital. TheraDoc infection surveillance and reporting technology was implemented at the hospital to enable the transmission of AUR reports and enhance infection control initiatives.

ciprofloxacin - Pseudomonas aeruginosa (January 2005 - January 2007)
Aggregate by quarter Location: All Site: All



AUR Messages Deliver Vital Clinical Data to CDC

Since August 2006, the message specifications were expanded to include admission/discharge/transfer (ADT) and pharmacy data. Currently, two pilot hospitals securely transmit all three types of data daily to CDC. The messages include individual patient records that can be used to derive the total grams of antibiotics used daily and data that reveals trends in antimicrobial-resistance patterns occurring in the hospital.

Historically, CDC received data from participating hospitals through a predominately manual process. Surveillance personnel collected and compiled relevant data and then manually entered them into NNIS and later into NHSN interface.

The AUR eSurveillance project allows clinical data to be automatically gathered and transmitted to CDC where they are aggregated and analyzed. The timely delivery of AUR data provides the CDC the opportunity to readily analyze and

confirm the link between antibiotic usage in hospitals and antimicrobial-resistance.

A Critical Mass of Hospitals is Necessary for Nationwide Surveillance

The AUR eSurveillance project will become increasingly powerful as it is broadly implemented in hospitals across the country. To provide meaningful data, CDC will require AUR data from a large number of institutions that are geographically diverse.

If the majority of the approximately 350 hospitals that currently provide HAI data to the NHSN utilize standards-based technology to transmit AUR message data to CDC, the country will be well on its way to establishing a nationwide AUR eSurveillance network. At this point, it is difficult to judge how rapidly a fully functioning network of hospitals will be built. It greatly depends on how quickly hospitals implement the necessary technology and choose to participate in AUR

eSurveillance. However, when critical mass is attained and a significant number of hospitals are daily transmitting AUR messages, CDC will be well positioned to help hospitals around the country manage antimicrobial resistance and combat drug-resistant infections.

The AUR eSurveillance project will improve the CDC's ability to conduct timelier surveillance for emerging resistance at institutional, state and federal levels. Eventually, the CDC will be able to generate reports based on collected data and provide hospitals in the United States comparative reports, similar to the current NHSN (formerly NNIS) annual reports.

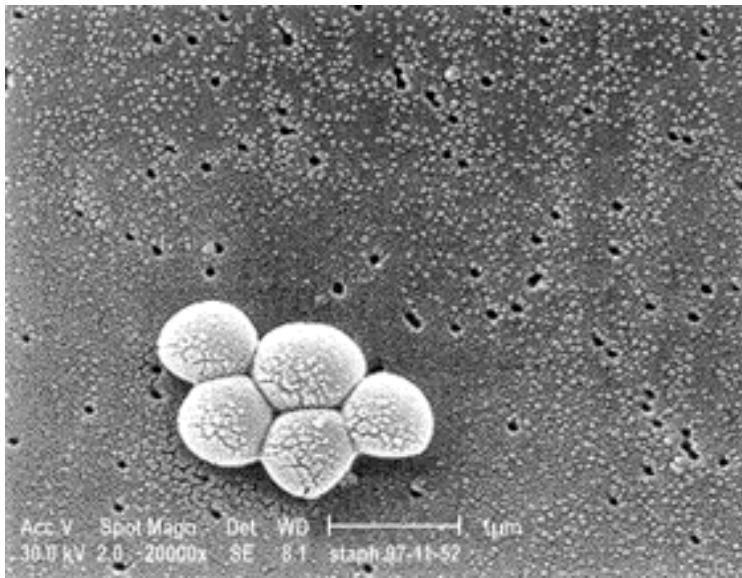
Therefore, future collection of AUR rates and, it could be said, the success of the AUR eSurveillance program as a component of NHSN, are largely dependent on increasing the number of participating hospitals.

Goals of NHSN's AUR eSurveillance

Given the participation of multiple hospitals around the country, the CDC plans to achieve the following key objectives through this cutting-edge project:

1. Develop antibiograms for identifying emerging antimicrobial resistance and tracking trends.
2. Monitor and track antimicrobial use in hospitals nationwide.
3. Track the percentage of change in specific drug to organism resistance patterns.
4. Unequivocally confirm the relationship between antimicrobial usage and emerging, multi-drug resistance.
5. Achieve real-time surveillance for emerging resistance, in specific geographical locations and eventually, nationwide.
6. Detect antimicrobial-resistant pathogens earlier.
7. Advance the nation's ability to reduce antimicrobial-resistance.

Photo courtesy of CDC/Janice Carr



Grouping of methicillin resistant *Staphylococcus aureus* (MRSA) bacteria.

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To actively participate in the NHSN's AUR eSurveillance, hospitals will be required to implement healthcare information technology that meets industry standards fostered by this collaboration. It is interesting to note that this type of technology has already proven to help hospitals enhance infection control and prevention programs, and significantly improve the quality and safety of patient care.

AUR Data from Multiple Hospitals Will Enable Public Health Improvements

The Northwestern Memorial and University of Utah hospitals originally implemented TheraDoc technology for these dual purposes. Now, the same real-time infection surveillance software is serving as a reporting system that daily transmits clinical data to the CDC. Participation by both of these leading hospitals represents a proactive and considerable contribution to the reduction of antimicrobial resistance and the improvement of public health.

AUR reports from these two innovative hospitals are only beginning to provide the data that the CDC needs to confirm the link between the inappropriate use of antibiotics and emerging resistance. As an initial step, the agency could develop region-specific antibiograms that can quickly reveal trends in emerging resistance by utilizing AUR reports from Northwestern Memorial Hospital and the University of Utah Hospital.

Ultimately, the AUR eSurveillance project has the potential to enable the CDC to proactively address antimicrobial resistance on behalf of the American public, significantly improve patient safety in healthcare organizations throughout the United States and provide the means to reduce this growing public health concern. †

Stan Pestotnik, MS, RPh, is the president and CEO of TheraDoc, a clinical informatics company dedicated to improving the quality, efficiency and safety of patient care through enhanced decision making. TheraDoc technology is increasingly being utilized by hospitals to meet mandates for the public reporting of healthcare-associated infections, and improve infection control and prevention programs.

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